WEBBING TIE DOWN ASSEMBLY

The present invention relates to a webbing tie down assembly or lashing restraint, having a clamping mechanism for securely clamping a webbing tie or lashing.

A webbing tie down assembly is provided in circumstances where webbing is used, for example, to tie down an object to a base, whereby the webbing can withstand applied loads arising from relative movement between the object and the base.

For instance, a plurality of webbing ties are used to secure a helicopter to the deck of a ship. Each webbing tie (or lashing) is fitted at one end to a fitting on the deck of the ship and at the other end is clamped and tensioned within a tie down assembly which is hooked onto a fitting of a helicopter.

A known webbing tie down assembly is shown in Figures 1A and 1B. The device comprises a hook, for fastening over a helicopter fitting, and a clamping and tensioning mechanism for a webbing tie. One end of the webbing tie is secured to a deck fitting, and the other free end is received within the clamping mechanism of the assembly as shown in Figures 1A and 1B. When the clamping mechanism is closed, a portion of the webbing is clamped between a roller shaft on one side and a clamping surface on the other side having a notch therein for gripping the webbing. Tensioning of the webbing is achieved by pulling on the free end of the webbing, as described in more detail below.

Although the existing webbing tie down assembly provides a combined clamping and tensioning mechanism, which is compact, lightweight, easy and convenient to use on the deck of a ship, it cannot sustain loads exceeding 5000lbs. Thus, even the use of about 20 webbing ties for an individual helicopter is insufficient to permanently secure it to the deck of a ship. Instead, heavy chains are used, to replace the temporary webbing ties, to ensure that a helicopter is safely secured to the deck of a ship.

The present invention aims to provide a webbing tie down assembly which achieves simple clamping and tensioning of the webbing, which can sustain increased loads compared with the prior art preferably enabling webbing ties to be used to permanently secure a helicopter to the deck of a ship, thereby obviating the need for securing chains.

The present invention is defined in accompanying claim 1.

The present invention thus provides a webbing assembly in which the webbing is clamped between a pair of substantially parallel clamping surfaces so that the clamping force on the webbing is distributed over a large surface area of the webbing. In a preferred embodiment the clamping surfaces are mutually opposed complementary curved surfaces.

In a preferred arrangement, the webbing assembly comprises a webbing clamping mechanism in which the webbing is wrapped around a plurality of pulley-like shafts which are arranged to uniformly distribute a load applied to the webbing when under tension.

Moreover, in the preferred embodiment the webbing assembly comprises a webbing clamping mechanism, in which guide surfaces for the webbing are provided which are arranged to prevent the webbing from coming into contact with itself when the mechanism is in use.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1A is a schematic side view of a prior art webbing tie down assembly;

Figure 1B is a schematic plan view of the prior art webbing tie down assembly of Figure 1A;

Figure 2 is a schematic view showing the use a webbing tie down assembly to secure a helicopter to the deck of a ship;

Figure 3 is a side view of a webbing tie down assembly forming a first embodiment;

Figure 3a is a schematic side view of a latching mechanism used with the webbing tie down assembly of Figure 3;

Figure 4 is a perspective view of the webbing tie down assembly of Figure 3;

Figure 5 is a perspective view of the inner parts of the webbing tie down assembly of Figure 3;

Figures 6a to c are schematic side views showing the embodiment of Figure 3 at various positions in use;

Figure 7 is a side view of a webbing tie down assembly forming a second embodiment;

Figure 8 is a perspective view of the webbing tie down assembly of Figure 7;

Figures 9a to c show the embodiment of Figure 7 in different positions in use;

Figure 10 is a side view of a webbing tie down assembly forming a third and preferred embodiment of the present invention;

Figure 10a is an enlarged side view of the clamping mechanism of the webbing tie down assembly of Figure 10;

Figure 11 is a perspective view of the webbing tie down assembly of Figure 10; and

Figures 12a to c show the embodiment of Figure 10 in different positions in use.

Figure 1 shows a known webbing tie down assembly comprising a pair of longitudinally extending parallel outer plates 3 enclosing a pair of parallel inner plates 5 which are linked together at a rear end of the assembly by a transversely extending handle 6. The thus linked inner plates 5 are together pivotally mounted on a roller shaft 7 extending transversely between, and secured to, the outer plates 3 such that the inner plates 5 lie parallel to the outer plates 3 and can pivot with respect thereto by movement of the handle 6. A hook 1, for attachment to the fitting of, for example, a helicopter, is formed integrally with the outer plates 3 at a front end of the assembly.

An upper clamping member 9 is secured between the inner plates 5 above the roller shaft 7 and has a notch 10 in a surface thereof opposing the surface of the roller shaft 7. The roller shaft 7 is mounted to the outer plates 3 through respective vertically extending slots 11 in the inner plates such that the roller shaft 7 can be displaced relative to the clamping member 9 by movement upwardly and downwardly within the slots 11.

Webbing 15 is passed into the assembly from the rear end, opposite to the front end which secures the hook 1, looped around the front of roller shaft 7, passed between the roller shaft 7 and clamping member 9, around the clamping member and returned out through the rear end of the assembly, as shown in Figure 1A.

In use, the hook 1 is secured to the fastening of the helicopter and the inner plates 5 are moved from the open position shown in solid outline in Figure 1A to the closed position shown in dashed outline in Figure 1A. A transversely extending latching bar 17, extending between the inner plates 5 and retained within respective longitudinally

extending slots 27 therein, is used to secure the inner plates 5 in the closed position with respect to the outer plates 3 by engagement with notches 29 in the outer plates 3.

In the closed position, the webbing 15 is clamped between the notch 10 in the clamping member 9 and the surface of the roller 7. From the clamped position, tension can be applied to the webbing 15 by pulling on the free end of the webbing. The pulling force is sufficient to displace the roller shaft 7 downwardly within the slots 11 in the inner plates 5, to remove the clamping force applied to the webbing and allow it to pass freely through the assembly between the clamping member 9 and the roller 7, without disengaging the latching bar 17 from the closed position.

Figure 2 illustrates one manner of use of the known webbing tie down assembly when securing a helicopter to the deck of a ship. This and other manners of use are possible with the webbing tie down assembly of the present invention.

Figures 3 to 5 show a webbing tie down assembly according to a first unclaimed embodiment. The assembly is generally similar in construction to the prior art assembly shown in Figures 1A and 1B.

The assembly thus comprises a pair of parallel inner plates 105 which are linked together by a handle 106 and are together pivotally mounted on a shaft 107 secured between a pair of parallel outer plates 103. The shaft 107 extends through a slot 111 in each of the inner plates 105 and is rigidly mounted to the outer plates 103.

A pair of securing points 123 are provided on the outer plates at a front end of the assembly for mounting a hook (not shown). The use of a pair of securing points prevents rotation of the hook relative to the outer plates 103.

A latching mechanism, shown in detail in Figure 3a, is provided to lock the inner plates 105 in the closed position (as shown in Figure 3) relative to the outer plates 103.

The latching mechanism comprises a latching bar 117 extending transversely between the inner plates 105 through longitudinally extending slots 127 in the inner plates 105 which cooperate with notches 129 in the outer plates 103 in the closed position. The latching bar 117 is biased by means of a leaf spring towards the front end of the slots 127 for engagement with the notches 129 in the outer plates 103 but can be released from engagement by sliding the latching bar 117 rearwardly along the slots 127 against the biasing force.

The clamping mechanism comprises an upper clamping member 119a mounted between the inner plates 105, and a lower clamping member 119b mounted between the outer walls 103. The clamping members 119a, 119b are mounted on the rear side of the assembly relative to the roller shaft 107.

The clamping members 119a, 119b provide respective mutually opposing generally planar clamping surfaces 120a, 120b, for clamping a relatively large surface area of the webbing 115, which passes between the two clamping surfaces 120a, 120b. It should be noted that the clamping members 119a, 119b have smooth surfaces and rounded edges to allow the webbing 115 to slide around the surfaces of the clamping members easily, without catching or tearing, as described below.

A pair of transversely extending pulley shafts 121a, 121b are mounted between the inner plates 105 in vertical alignment. It should be noted that the pulley shafts 121a, 121b are provided on the front side of the assembly relative to the roller shaft 107, and are spaced equidistantly therefrom.

The pulley shafts 121a, 121b and roller shaft 107 are preferably made from hard drawn stainless steel, as is a load bearing shaft 124 mounting the upper clamping member 119a to the inner plates 105. The shaft 124 bears a large proportion of the load, as described below.

Webbing 115 is passed through the assembly as shown in Figure 3. In particular, the free end of the webbing 115a is inserted into the rear end of the assembly between the inner plates 105, wrapped around the front sides of the pulley shafts 121a, 121b, over the upper surface of the upper clamping member, around the curved rear of the upper clamping member where the load bearing shaft 124 is positioned, between the clamping surfaces of the first and second clamping members 119a, 119b, around the roller shaft 107 and then back out through the rear end of the assembly. It should be noted that the pulley shafts 121a, 121b and clamping members 119a, 119b are arranged to uniformly distribute any load applied to the webbing 115 whilst keeping the surfaces of the webbing apart.

Figures 6a to c show the various positions of the first embodiment, in use.

Referring to Figure 6c, the latching bar 117 is disengaged from the notches 129 within the outer plates 103, so that the inner plates 105 can be pivoted about the roller shaft 107 by lifting of the handle 106 to the illustrated open position. In this position, the webbing 115 is neither clamped nor under tension, and is free to run around the pulley mechanism and between the clamping surfaces to enable the hook 101 to be released from, or secured to, for example, a helicopter fitting as shown in Figure 2.

Once the hook 101 has been secured to the helicopter fitting, the handle 106 is lowered to rotate the inner plates back around shaft 107 to the closed position as shown in Figure 3 and the latching bar 117 engages the notches in the outer plates to retain the inner plates in the closed position relative to the outer plates. It is then necessary to pull taut the webbing 115 which extends between the deck and the helicopter, and this is achieved by simply pulling on the free end 115a as shown by the arrows in Figure 6a to tension the webbing 115. The force applied to the free end 115a of the webbing exerts a force on the roller shaft 107 which displaces the roller shaft 107 downwardly within the slots 111 in the inner plates 105. The ends of the roller shaft 107 are secured to the outer plates 103, which mount the lower clamping member 119b, so that the outer plates 103 and lower clamping member 119b are also displaced downwardly, thus disengaging the

clamping surfaces of the upper and lower clamping members and permitting the webbing 115 to move therebetween. Thus, the webbing 115 can be pulled through the assembly to apply tension to the webbing 115 and thus remove any slack between deck and helicopter.

Figure 6b shows the forces applied to the webbing 115 when the assembly is in use. In particular, when the helicopter is secured to the deck of a ship, the movement of the deck will cause the helicopter to sway, and an increased load to be applied to the webbing 115. The load is particularly applied to the shaft 124 securing the upper clamping member 119a, but is also distributed over the pulley shafts 121a, 121b. In this position, the clamping surfaces 120a, 120b are brought together so that they lie essentially parallel and apply clamping pressure to the webbing 115 as shown. This clamping effect is achieved because roller shaft 107 moves upwardly within the slots 111 in the inner plates 105 to align the clamping surfaces 120a, 120b parallel with each other with the distance between them slightly less than the thickness of the webbing.

A second embodiment, also unclaimed, is shown in Figures 7 to 9. The structural features of this embodiment are generally the same as the first embodiment and the following description relates mainly to the different features of the second embodiment.

In this second embodiment, the roller shaft 207 is located in slots 211 in the outer plates 203, which slots 211 extend in an arc generally centred about the axis of the latching bar 217. The slots 211 thus permit displacement of the inner plates 205 within the outer plates 203 whereas in the first embodiment the outer plates are displaced relative to the inner plates.

The arcuate curvature of slots 211, being generally centred about the axis of the latching bar 217, prevents the latching bar 217 from movement, arising during clamping and unclamping of the webbing, which can lead to wear in the region surrounding the notches which engage the bar 217. Instead, the roller shaft 207 can take up this movement, within the arcuate slots, so that the axis of the latching bar 217 remains

stationary during tensioning of the webbing, thus preventing wear. The arcuate shape of slots 211 thus provides advantages over the vertically extending slots 111 of the first embodiment, and it will be appreciated that this feature can be incorporated within the design of the first embodiment, if desired.

In the second embodiment, the clamping members 219a, 219b are arranged in a similar manner to the first embodiment, whereby the generally planar clamping surfaces 220a, 220b are aligned parallel, and clamp a large surface area of the webbing 215 when under tension. The pulley shafts 221a, 221b, however, are arranged on the same side of the roller shaft 207 as the latching bar 217. The pulley shafts 221a, 221b, together with the clamping surfaces, are positioned to guide the webbing 215 and distribute the load between them, whilst ensuring that the surfaces of different parts of the webbing 215 are kept out of contact with each other.

The positions of the assembly, in use, are shown in Figure 9a to c and correspond with the positions shown in Figures 6a to c as described above in respect to the first embodiment. As can be seen from Figure 9a, when the webbing 215 is being tightened by pulling on the free end 215a, the clamping surfaces are released from contact with the webbing 215 as the roller shaft 207 moves upward to the upper end of the arcuate slots 211 and tilts the inner plates 205 relative to the outer plates 203, as shown. When the webbing 215 is under tension, as shown in Figure 6b, the roller shaft 207 moves downwardly within the arcuate slots 211 to align the inner plates 205 with respect to the outer plates 203, and thus to position the clamping surfaces 220a, 220b parallel to each other, as shown.

In the second embodiment, the upper clamping member 219a has a larger surface area than in the first embodiment to provide a larger contact surface and distribute the clamping force across a larger surface area of the webbing 215.

The materials and gauge of the components of the assembly are chosen to be lighter in weight than the first embodiment, that is, components are formed from aluminium alloys wherever possible and narrower gauge components are employed. It will be appreciated that the assembly should be as light as possible for an individual to carry several at a time, whilst meeting the functional load-bearing requirements. Thus, the described assemblies need to balance the features of heavy and relatively thick hard drawn stainless steel shafts necessary to perform load bearing functions, and more lighter weight material.

Figures 10 to 12 show a webbing tie down assembly according to a third and preferred embodiment in accordance with the present invention. Like the first embodiment, the assembly of the third embodiment is similar in construction to the prior art assembly shown in Figures 1A and 1B, but dimensioned on a larger scale and with higher grade materials to achieve the increased load bearing requirements.

In particular, the assembly comprises a pair of parallel inner plates 305 which are linked together by a handle 306 and are together pivotally mounted on a roller shaft 307 secured between a pair of parallel outer plates 303. The shaft 307 extends through a slot 311 in each of the inner plates 305 and is rigidly mounted to the outer plates 303.

A pair of securing points 323 are provided on the outer plates at a front end of the assembly which mount a hook 301. The use of a pair of securing points prevents rotation of the hook relative to the outer plates 303.

As in the first and second embodiments, a latching mechanism is provided to lock the inner plates 305 in the closed position relative to the outer plates 303. The latching mechanism comprises a latching bar 317 extending transversely between the inner plates 305 through longitudinally extending slots 327 in the inner plates 305 which cooperate with notches 329 in the outer plates 303 in the closed position. The latching bar 317 is biased by means of a leaf spring towards the front end of the slots 327 for engagement

with the notches 329 in the outer plates 303 but can be released from engagement by sliding the latching bar 317 rearwardly along the slots 327 against the biasing force.

The clamping mechanism of the third embodiment differs from the clamping mechanism of the first and second embodiments. In particular, instead of providing planar surfaces for clamping the webbing over a relatively large surface area, the third embodiment incorporates complementary curved clamping surfaces for clamping the webbing.

Referring to Figure 10, the clamping mechanism comprises an upper clamping member 309 mounted between the inner plates 305, and the roller shaft 307 forms the lower clamping member. The shape of the upper clamping member 309 is particularly important for the clamping function and will be described in detail hereinafter, with reference to Figure 10a.

In accordance with the present invention, the clamping surface 320 of the upper clamping member 309, which opposes the surface of roller shaft 307, is formed with a curvature complementary to the curvature of the shaft such that when webbing 315 is clamped between the clamping members 307, 309 the clamping surfaces lie substantially parallel, separated by a distance slightly less than the normal thickness of the webbing, thus applying a generally uniform clamping force over a large surface area of the webbing.

The remainder of the surface of the upper clamping member 309 is smoothly curved to allow the webbing 315 to slide around the clamping member without catching or tearing. It is particularly important that the curvature of the front end surface 309a of the upper clamping member 309 has a sufficiently large radius of curvature at the point r in Figure 10a to prevent undue tension on the webbing which can lead to wear. In an example, the minimum radius of curvature r is five eighths of an inch (approx 15.9mm) for the dimensions of the assembly. The minimum radius of curvature at point r is

6.35mm as illustrated in Figure 10a. However, it is also advantageous if the upper surface of the upper clamping member extends below the level of the inner plates 305, so that the inner plates act to guide the webbing 315 therebetween as it passes over the upper clamping member 309, without the risk of the webbing "riding up" and catching on one of the inner plates.

Webbing 315 is passed through the assembly as shown in Figure 10. In particular, the free end of the webbing 315a is inserted into the rear end of the assembly between the inner plates 305, passed beyond the front of the shaft 307 and then over upper clamping member 309 and rearwardly over the upper surface of the upper clamping member 309, then forwardly between the clamping surface 320 of the upper clamping member 309 and the roller shaft 307, around the front of the roller shaft 307 and then back out through the rear end of the assembly, as shown.

Figures 12a to 12c show the various positions of the third embodiment in accordance with the present invention, in use, and will not be described since they correspond to the positions shown in Figures 6a to 6c of the first embodiment described above.

The preferred embodiment of the present invention is designed for use with relatively thick polyester webbing having a breaking force in excess of 15000lb. The thickness of the webbing is not however critical, and the webbing tie down assembly has been found to work effectively with a variety of webbing thicknesses.

It is anticipated that the webbing tie down assembly of the present invention can be used, in conjunction with webbing having the abovementioned breaking force, to permanently secure a helicopter to the deck of a ship, without the need for chains.

It will be appreciated that various modifications may be made to the described embodiments, to meet the working requirements including the thickness and material of

the webbing, and the load which the assembly is designed to withstand. For instance, the skilled person will appreciate that the curvature of the upper clamping member of the third embodiment could be achieved using a pair of bolts, mounted parallel to each other, with the required radius of curvature.

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